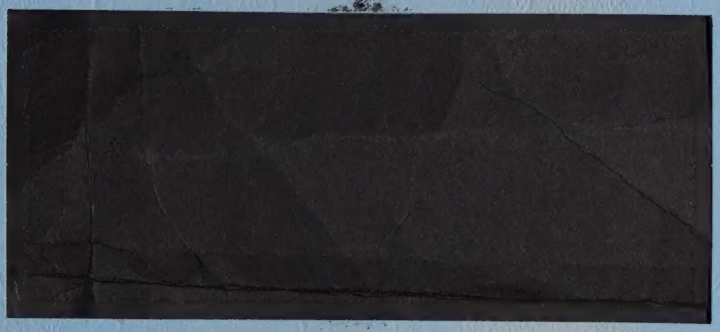
LORAIN

POWER EQUIPMENT



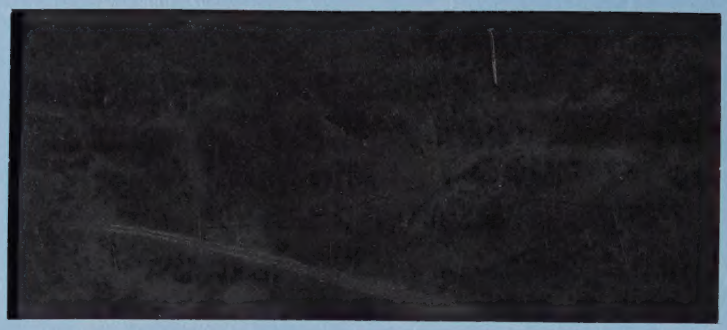
INSTRUCTIONS

INSTALLATION

OPERATION

MAINTENANCE

RELIANCE COMM/TEC



LORAIN® MODEL T50P

SUB-CYCLE® LINEAR CONTROL

50 VA RINGING GENERATOR

Spec. No. 4871-060 Serial No. _____

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LORAIN PRODUCTS
Division of Reliance Electric Co.

WARRANTY

Seller warrants that the products it manufactures or sells shall be free from defects in material and workmanship during the first 90 days after the product is activated. During said period, Seller will repair or replace any defective parts free of charge to Buyer, including any labor costs. In addition, Seller shall repair or replace any defective parts, so discovered by Buyer to be defective within two years from the date of shipment of same, provided Buyer promptly so notifies Seller. In no case shall Seller's liability under this warranty extend beyond two years from the date of shipment of said product. This warranty shall not apply to any products which are misused, modified, repaired, or otherwise abused by Buyer or others. The repair or replacement of defective parts, or the refund of the invoice cost thereof, as shall be determined by Seller in its sole discretion, shall be the limit of Seller's liability hereunder and shall be Buyer's sole and exclusive remedy.

Handling or service charges in connection with the return of such products, if approved by Seller, shall be charged as determined by Seller. Seller shall not be liable in any event for any general or special, incidental or consequential damages to Buyer in excess of the amount of the purchase price of the products.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES. SELLER MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE WITH RESPECT TO ANY PRODUCTS EXCEPT AS HEREIN EXPRESSLY PROVIDED.

SYSTEMS AND EQUIPMENT NOT ECONOMICALLY RETURNABLE TO THE FACTORY

In the event that the product involved is a system or equipment which, in the judgement of Lorain Products, is not economically returnable to the factory or if Lorain Products has performed the installation, supervised the installation, or performed testing and turn-on, circuit components and Lorain repair labor are covered by this warranty for the first 90 days from date of turn-on and circuit components are warranted for two years from the date of shipment. Upon request, Lorain will send a service technician to the site to determine if the unit is defective in circuit components or workmanship, and will repair the equipment. If the failure is Lorain's fault, no invoice for circuit components or repair labor will be issued if the complaint has been issued within the first 90 days from date of turn-on. If the complaint is issued more than 90 days from the date of turn-on but within two years from date of shipment, the customer will be billed at the prevailing Customer Service rates but will not be billed for circuit components. If the problem occurs after two years from the date of shipment, circuit component and repair labor are billable.

If the problem has been created by misuse or abuse of the equipment or by malfunction of associated equipment or by environmental conditions, at any time after shipment, the customer will be billed for circuit component and labor.

GENERAL PROVISIONS

Lorain Products shall not be obligated to pay any costs or charges incurred by the customer or by any other party. In no event will Lorain Products be liable for consequential damages. No waiver, alteration or modification of any of the provisions herein shall be binding on Lorain Products unless in writing and signed by an authorized official of Lorain Products. If, during any warranty period, the subject equipment has, in the opinion of Lorain Products, been modified or misrepaired, the warranty will be void unless the modifications or repairs have been made after consultation with Lorain Products and upon the recommendation of Lorain Products.

ATTENTION

The printed circuit cards used in this ringing equipment contain static sensitive devices. The warnings listed below must be observed to prevent damage to these devices. Disregarding any of these warnings may result in damage to the equipment.

1. Do not insert or remove modules with power applied. Wait at least 1 minute after power is turned off (or until power supplies have discharged to zero volts) before removing any module.

2. Before touching any static sensitive device or printed circuit card containing such a device, discharge all static electricity from yourself by wearing a wrist strap grounded through a one megohm resistor.

3. Do not touch the traces or components on a printed circuit card containing static sensitive devices. Handle the printed circuit card only by the edges. Exercise extreme caution when changing jumper options on the circuit card.

4. Store and ship static sensitive devices or printed circuit cards containing such devices only in conductive or anti-static containers.

November 2, 1982 Section 4318

LORAIN PRODUCTS

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Productos Lorain de Mexico, S.A. de C.V., Apartado Postal 77001
TEL. 576-82-77/TLX./01774308 (1774308 LORME)

RELIANCE COMM/TEC

ATTENTION

LORAIN® SUB-CYCLE®
LINEAR CONTROL RINGING GENERATOR
MODEL T25P, SPEC. NO. 4871-074
MODEL T25P, SPEC. NO. 4871-063
MODEL T50P, SPEC. NO. 4871-060

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APPENDIX

1. MODEL DATA

1.01 Refer to the Power Data sheet for information concerning input and output ratings, operating limits, and dimensions.

2. DESCRIPTION

General

2.01 The LORAIN Model T25P and Model T50P SUB-CYCLE Linear Control Ringing Generators operate from a nominal 48 VDC power source and supply one ringing output, with an adjustable frequency range of 16 Hz to 66 2/3 Hz and adjustable voltage ranges of 65 to 90 VAC RMS and 90 to 155 VAC RMS. The Model T25P ringing generator supplies up to 25VA of ringing power, while the Model T50P supplies up to 50VA of ringing power. These ringing generators are designed for use in a compatible LORAIN equipment cabinet.

2.02 Output power handling capability can be increased by connecting plug-in module type ringing generators of the same power rating in parallel.

3. OPERATION

Installation

3.01 These ringing generators can be installed in a compatible LORAIN equipment cabinet as follows:

CAUTION

If the ringing generator is used as a slave ringing generator in a parallel configuration, internal wiring changes are required. Refer to Paragraph 4.05 for adjustment information.

a) Remove input fuse F1, located on the front panel of the ringing generator.

b) Refer to Paragraph 4.01 through 4.03 for internal adjustments necessary to obtain a required output frequency and voltage.

c) Insert the ringing generator into the equipment cabinet and tighten the fastening screws.

WARNING

The rear panel of this plug-in module has been correctly adjusted to allow insertion into the associated equipment cabinet with a minimum of difficulty. Adjustment of the rear panel in the field should not be attempted.

DANGER

In the next step, 48 volt battery voltage is present at input fuse F1 fuseholder. Use standard precautions to avoid possibility of electrical shock.

d) Insert input fuse F1 into the ringing generator fuseholder.

e) This completes the ringing generator installation procedure. Refer to Paragraph 4.01 for output frequency and Paragraph 4.03 for voltage adjustment procedures.

Starting and Stopping

3.02 Applying -48V and GND to the input terminals located on the equipment cabinet backplane starts the ringing generator. The ringing generator output is enabled by applying GND (+BAT) potential to the ground start terminal, located on the equipment cabinet backplane. Removing the ground start potential turns off the ringing generator output.

Indicators

3.03 The following light emitting diode type indicators, located on the ringing generator front panel, indicate the status of the ringing generator:

GEN ON: Illuminates when ringing voltage is present at the ringing generator output.

OUTPUT OVERLOAD: Illuminates when ringing generator output current decreases due to an excessive output load voltage.

Fuses

3.04 This ringing generator has a 5 ampere input fuse, located on the ringing generator front panel. A Bussmann GMT5 or equivalent fuse should be used as a replacement, if necessary.

Fuse Alarm Indication

3.05 Negative resistance battery is supplied at an alarm terminal if the input fuse opens.

Overload Current

3.06 Overload current is factory adjusted to approximately 300 milliamperes for Model T25P and 550 milliamperes for Model T50P. Adjustment of this setting is not recommended.

4. ADJUSTMENTS

Frequency

4.01 Output frequency is adjusted by changing position of four Dual Inline Package (DIP) switch rockers to select the required frequency range, and then adjusting the FREQ ADJ potentiometer, located on the ringing generator front panel, to the desired output frequency. Refer to Table 1 for frequency ranges, and Table 2 for typical frequency and voltage combinations.

4.02 The following procedure should be used to adjust output frequency:

CAUTION

If the ringing generator has been used as a slave ringing generator in a parallel configuration, internal wiring changes are required. Refer to Paragraph 4.05 for adjustment information.

DANGER

In the next step, 48 volt battery voltage is present at input fuse F1 fuseholder. Use standard precautions to avoid possibility of electrical shock.

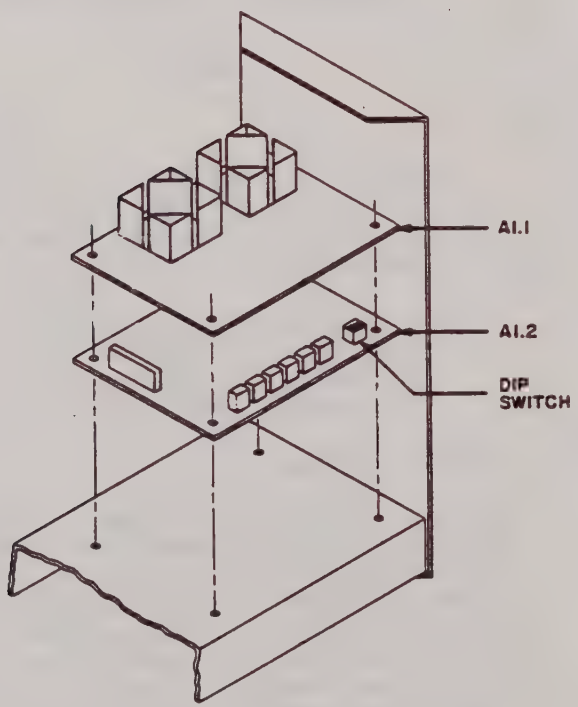
a) Remove input fuse F1 from the ringing generator being adjusted.

WARNING

If the ringing generator being adjusted is a master ringing generator in a parallel configuration, input fuse F1 should be removed from all slave ringing generators before the master ringing generator is removed from an equipment cabinet.

b) If the ringing generator is installed in an equipment cabinet, loosen the fastening screws and remove the ringing generator from the cabinet.

c) Position the four DIP switch rockers as required. Refer to Table 1 and Figure 1.



LOCATION OF DIP SWITCH

Figure 1

d) Insert the ringing generator into the equipment cabinet and tighten the fastening screws.

WARNING

The rear panel of this plug-in module has been correctly adjusted to allow insertion into the associated equipment cabinet with a minimum of difficulty. Adjustment of the rear panel in the field should not be attempted.

DANGER

In the next step, 48 volt battery voltage is present at input fuse F1 fuseholder. Use standard precautions to avoid possibility of electrical shock.

e) Insert input fuse F1 into the ringing generator fuseholder.

f) Connect a frequency meter to the OUTPUT TEST jacks located on the front panel of the ringing generator.

g) To adjust output frequency, adjust the front panel mounted FREQ ADJ potentiometer clockwise to increase frequency, and counterclockwise to decrease frequency.

Frequency Range	SWITCH POSITIONS			
	1	2	3	4
16-19 Hz	Cl	Op	Op	Op
18-25 Hz	Cl	Cl	Op	Op
23-34 Hz	Cl	Op	Cl	Op
25-39 Hz	Cl	Cl	Cl	Op
34-67 Hz	Cl	Op	Op	Cl

Op (Open)

Cl (Closed)

Table 1

Voltage

4.03 Voltage adjustment is accomplished by adjusting the VOLT ADJ potentiometer located on the front panel of the ringing generator, and selection of an output transformer tap for either 65 to 90 VAC or 90 to 155 VAC output adjustment ranges. Unless otherwise specified, these ringing generators are factory adjusted for 90 to 155 volt output. If 65 to 90 volt output is required, © option, refer to Paragraph 4.04. When adjusting output voltage, an AC RMS voltmeter with a range of at least 0-160 volts should be connected to the OUTPUT TEST jacks located on the front panel of the ringing generator. Adjust the VOLT ADJ potentiometer clockwise to increase voltage, and counterclockwise to decrease voltage. Refer to Table 2 for typical frequency and voltage combinations.

FIVE FREQUENCY HARMONIC SERIES

Freq. (Hz)	16 2/3	25	33 1/3	50	66 2/3
Output Volts	90	100	110	125	140

FIVE FREQUENCY SYNCHROMONIC SERIES

Freq. (Hz)	16	30	41	54	66
Output Volts	90	105	115	125	140

REA SYNCHROMONIC SERIES

Freq (Hz)	20	30	42	54	66
Output Volts	95	105	115	125	140

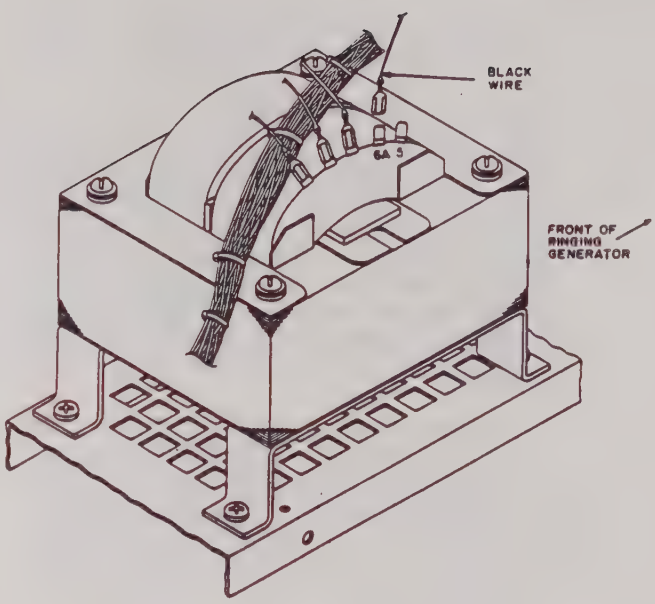
FIVE FREQUENCY DECIMONIC SERIES

Freq (Hz)	20	30	40	50	60
Output Volts	95	105	115	125	135

Table 2

Output Tap Selection

4.04 The following procedure should be used to change output voltage adjustment ranges. Refer to Figure 2.



TRANSFORMER TAP ADJUSTMENT

Figure 2

a) 65-90 VAC Output: The two black leads connected to terminal 5 or 6A on transformer T1 should be connected to terminal 6A for 65-90 VAC output.

b) 90-155 VAC Output: The two black leads connected to terminal 5 or 6A on transformer T1 should be connected to terminal 5 for 90-155 VAC output.

Parallel Operation

4.05 The Model T25P Ringing Generator can be connected in parallel with additional 25VA plug-in module type ringing generators to increase power handling capability in increments of 25VA. The Model T50P Ringing Generator can be connected in parallel with additional 50VA plug-in module type ringing generators to increase power handling capability in increments of 50VA. When interconnected, paralleled ringing generator outputs are the same frequency and voltage, and output waveshapes are in phase.

4.06 Paralleled ringing generators consist of one master ringing generator and one or more slave ringing generators. Output frequency and voltage of the paralleled ringing generators is determined by the adjustment of the master ringing generator.

4.07 Slave ringing generators require an internal wiring change before paralleling. Master ringing generators do not require any modifications when used in a parallel configuration. Additional wiring on the equipment cabinet backplane may be necessary when paralleling ringing generators. Refer to the equipment cabinet Power Data sheet for additional information.

CAUTION

Ringing generators of different power ratings should not be paralleled.

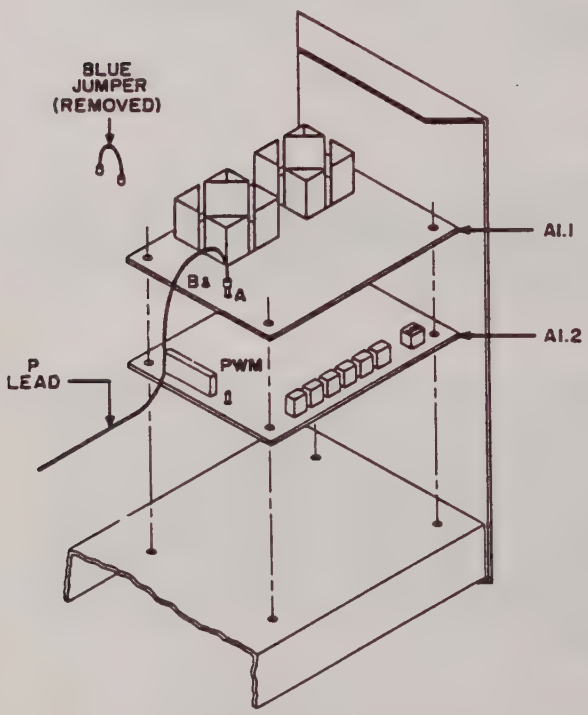
CAUTION

All associated master and slave ringing generators must be adjusted to provide the same output voltage range, i.e., 90 to 155 volts, or 65 to 90 volts © option . Refer to Paragraphs 4.03 and 4.04.

WARNING

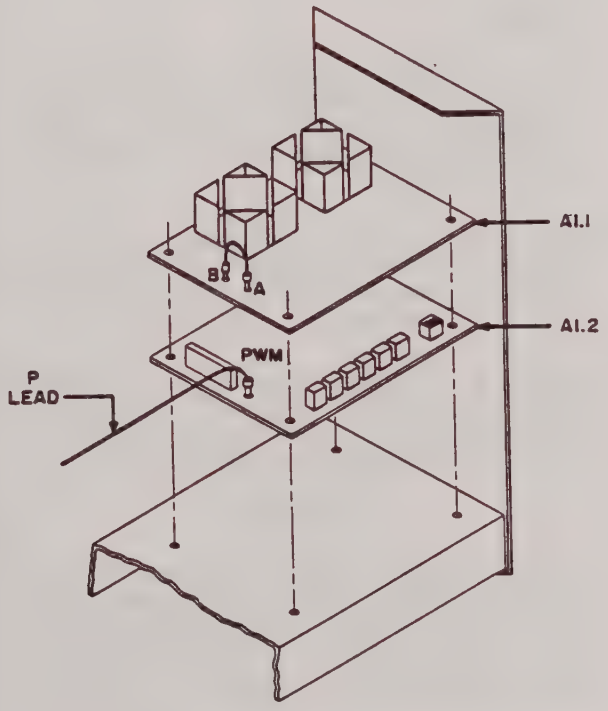
Input fuse F1 should be removed from all slave ringing generators before the master ringing generator is removed from an equipment cabinet.

4.08 The following procedure should be used to modify a ringing generator for use as a slave ringing generator in a parallel configuration. Refer to Figure 3.



SLAVE RINGING GENERATOR CONNECTIONS

Figure 3



MASTER (NORMAL) RINGING GENERATOR CONNECTIONS

Figure 4

a) Remove the blue jumper attached to pins A and B on circuit card A1.1.

b) Remove the P lead from pin PWM on circuit card A1.2 and connect it to pin A on circuit card A1.1.

c) Adjust the VOLT ADJ potentiometer, located on the front panel of the ringing generator, full counterclockwise.

4.09 The following procedure should be used to convert a slave ringing generator to a master (normal) ringing generator. Refer to Figure 4.

a) Remove the P lead from pin A on circuit card A1.1 and connect it to pin PWM on circuit card A1.2.

b) Connect the blue jumper to pins A and B on circuit card A1.1.

5. TROUBLESHOOTING

General

5.01 The fault isolation chart, shown in Figure 5, aids troubleshooting by allowing a technician to isolate a malfunction by answering a series of questions which require a yes or no answer.

5.02 Due to the complex interactions between modules in a ringing system, failure of one module could cause erroneous failure indications in additional modules.

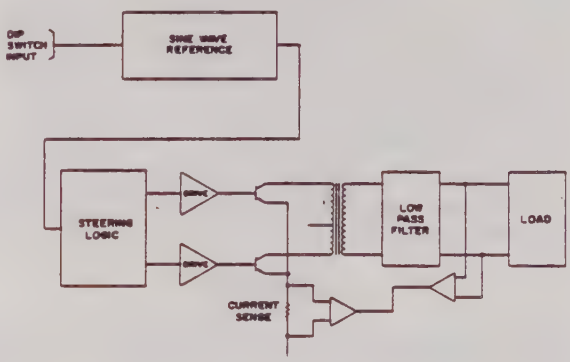
5.03 When it is determined that the trouble condition is caused by one module, the module should be replaced. No attempt should be made to troubleshoot or repair the module.

WARNING

If a master ringing generator in a parallel configuration fails, remove input fuse F1 from all slave generators before removing the master ringing generator from an equipment cabinet.

6. CIRCUIT DESCRIPTION

6.01 This ringing generator uses a monolithically generated sine wave reference to control a pulse width modulated style inverter. Refer to Figure 6.

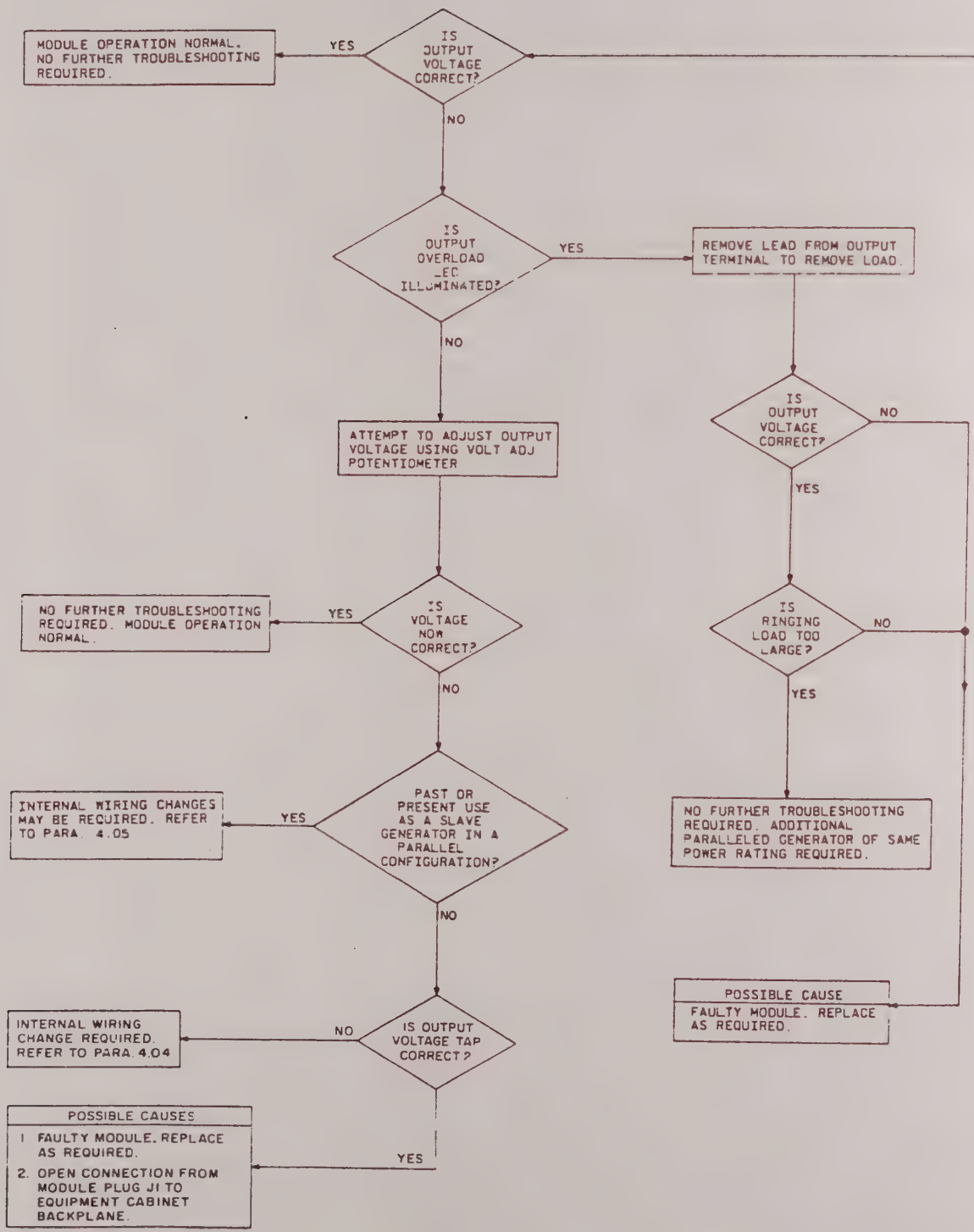


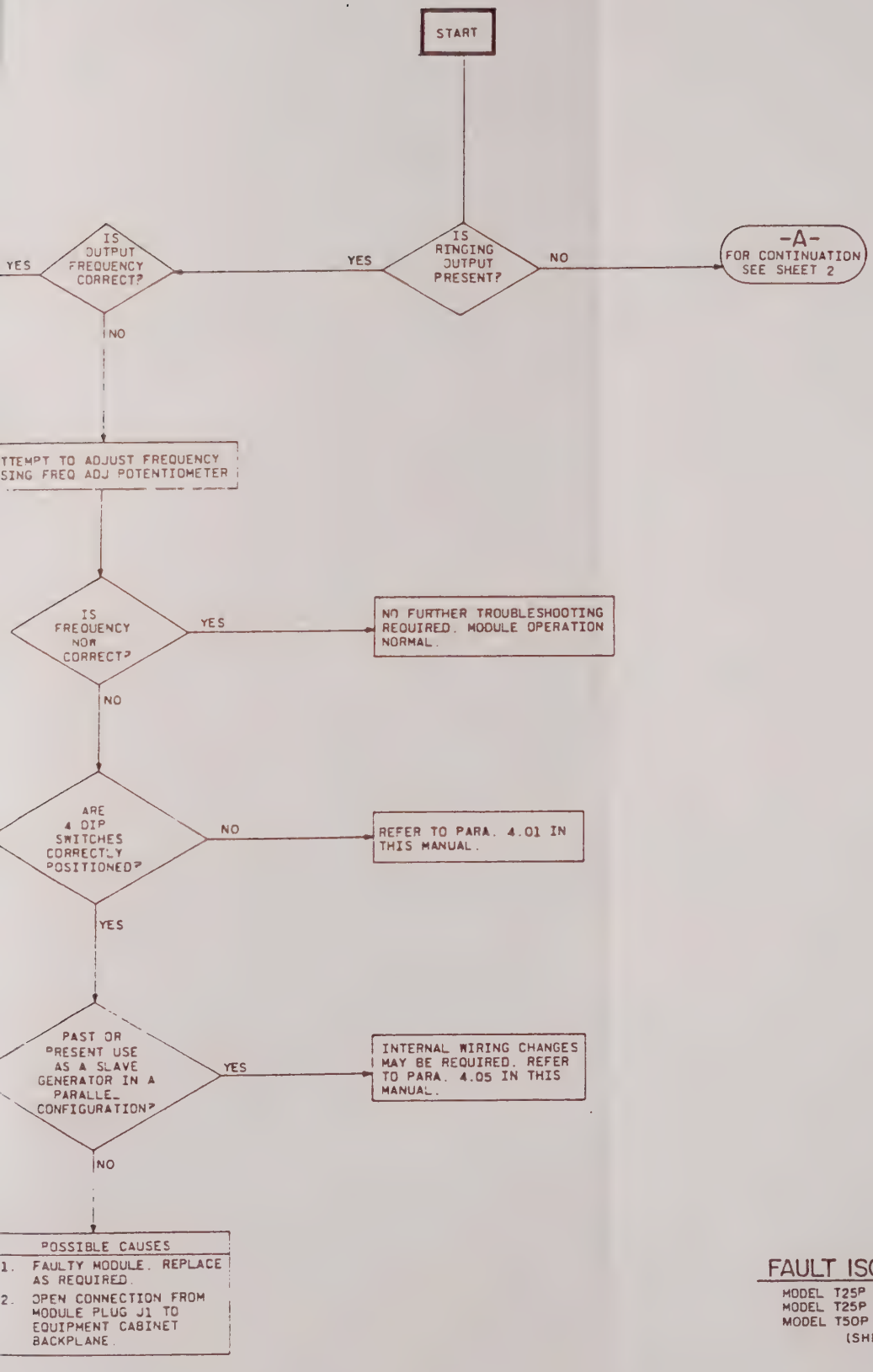
FUNCTIONAL BLOCK DIAGRAM

Figure 6

6.02 The sine wave reference output is determined by the positions of the four DIP switches, adjustment of the FREQ ADJ potentiometer, and the adjustment of the VOLT ADJ potentiometer.

6.03 At the same time, a high frequency triangular wave is generated. The two waves are compared to achieve a pulse width modulated (PWM) wave. The PWM signal is split into two signals 180° out of phase. These signals are amplified and used as base drive for the main power transistors to drive the push-pull primary of the output transformer. The output wave is filtered and applied to the load.

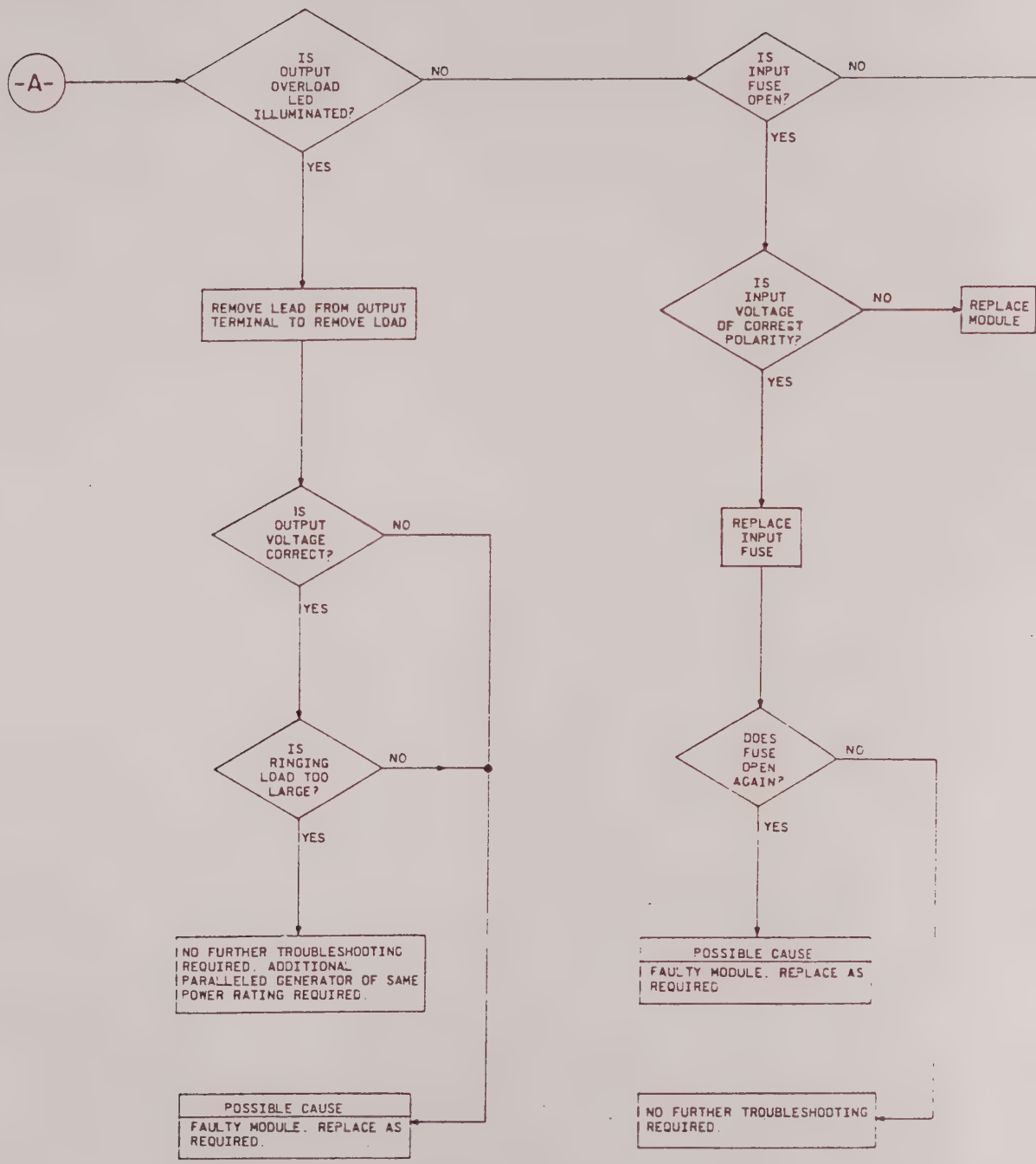

IS OUTPUT VOLTAGE CORRECT?
YES
MODULE OPERATION NORMAL. NO FURTHER TROUBLESHOOTING REQUIRED.
NO
IS OUTPUT OVERLOAD LED ILLUMINATED?
YES
REMOVE LEAD FROM OUTPUT TERMINAL TO REMOVE LOAD.
NO
ATTEMPT TO ADJUST OUTPUT VOLTAGE USING VOLT ADJ POTENTIOMETER
IS OUTPUT VOLTAGE CORRECT?
NO
YES
IS VOLTAGE NOW CORRECT?
YES
NO FURTHER TROUBLESHOOTING REQUIRED. MODULE OPERATION NORMAL.
NO
IS RINGING LOAD TOO LARGE?
NO
YES
NO FURTHER TROUBLESHOOTING REQUIRED. ADDITIONAL PARALLELED GENERATOR OF SAME POWER RATING REQUIRED.
PAST OR PRESENT USE AS A SLAVE GENERATOR IN A PARALLEL CONFIGURATION?
YES
INTERNAL WIRING CHANGES MAY BE REQUIRED. REFER TO PARA. 4.05
NO
IS OUTPUT VOLTAGE TAP CORRECT?
NO
INTERNAL WIRING CHANGE REQUIRED. REFER TO PARA. 4.04
POSSIBLE CAUSE
FAULTY MODULE. REPLACE AS REQUIRED.
YES
POSSIBLE CAUSES
1. FAULTY MODULE. REPLACE AS REQUIRED.
2. OPEN CONNECTION FROM MODULE PLUG J1 TO EQUIPMENT CABINET BACKPLANE.

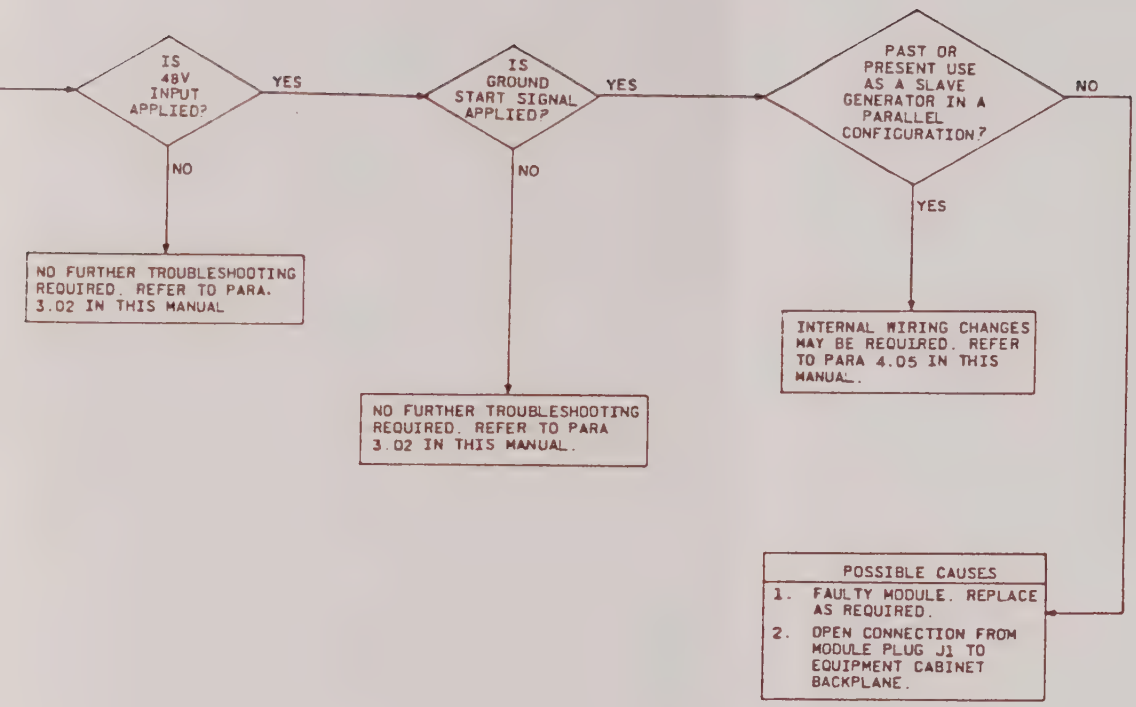

START
IS RINGING OUTPUT PRESENT?
YES
NO
-A-
FOR CONTINUATION SEE SHEET 2
IS OUTPUT FREQUENCY CORRECT?
YES
NO
TTEMPT TO ADJUST FREQUENCY SING FREQ ADJ POTENTIOMETER
IS FREQUENCY NOW CORRECT?
YES
NO FURTHER TROUBLESHOOTING REQUIRED. MODULE OPERATION NORMAL.
NO
ARE 4 DIP SWITCHES CORRECTLY POSITIONED?
NO
REFER TO PARA. 4.01 IN THIS MANUAL.
YES
PAST OR PRESENT USE AS A SLAVE GENERATOR IN A PARALLE_ CONFIGURATION?
YES
INTERNAL WIRING CHANGES MAY BE REQUIRED. REFER TO PARA. 4.05 IN THIS MANUAL.
NO
POSSIBLE CAUSES
1. FAULTY MODULE. REPLACE AS REQUIRED.
2. OPEN CONNECTION FROM MODULE PLUG J1 TO EQUIPMENT CABINET BACKPLANE.

FAULT ISOLATION CHART

MODEL T25P SPEC. NO. 4871-063
MODEL T25P SPEC. NO. 4871-074
MODEL T50P SPEC. NO 4871-060
(SHEET 1 OF 2)

Figure 5


-A-
IS OUTPUT OVERLOAD LED ILLUMINATED?
NO
YES
IS INPUT FUSE OPEN?
NO
YES
REMOVE LEAD FROM OUTPUT TERMINAL TO REMOVE LOAD
IS INPUT VOLTAGE OF CORREST POLARITY?
NO
REPLACE MODULE
YES
IS OUTPUT VOLTAGE CORRECT?
NO
YES
REPLACE INPUT FUSE
IS RINGING LOAD TOO LARGE?
NO
YES
DOES FUSE OPEN AGAIN?
NO
YES
NO FURTHER TROUBLESHOOTING REQUIRED. ADDITIONAL PARALLELED GENERATOR OF SAME POWER RATING REQUIRED.
POSSIBLE CAUSE
FAULTY MODULE. REPLACE AS REQUIRED.
POSSIBLE CAUSE
FAULTY MODULE. REPLACE AS REQUIRED
NO FURTHER TROUBLESHOOTING REQUIRED.


IS 48V INPUT APPLIED?
YES
NO
NO FURTHER TROUBLESHOOTING REQUIRED. REFER TO PARA. 3.02 IN THIS MANUAL
IS GROUND START SIGNAL APPLIED?
YES
NO
NO FURTHER TROUBLESHOOTING REQUIRED. REFER TO PARA 3.02 IN THIS MANUAL.
PAST OR PRESENT USE AS A SLAVE GENERATOR IN A PARALLEL CONFIGURATION?
NO
YES
INTERNAL WIRING CHANGES MAY BE REQUIRED. REFER TO PARA 4.05 IN THIS MANUAL.
POSSIBLE CAUSES
1. FAULTY MODULE. REPLACE AS REQUIRED.
2. OPEN CONNECTION FROM MODULE PLUG J1 TO EQUIPMENT CABINET BACKPLANE.

FAULT ISOLATION CHART

MODEL T25P SPEC. NO. 4871-063
MODEL T25P SPEC. NO. 4871-074
MODEL T50P SPEC NO 4871-060

Figure 5

APPENDIX

RECORD OF INSTRUCTION CHANGES		
ISSUE OR DATE	ECN	DESCRIPTION OF CHANGE
7	183-8063 183-7891	65-90 VAC output tap added.
8	-	Paragraphs 3.05, 3.06 corrected.

LORAIN PRODUCTS

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Reliance Telecommunication Products Ltd., 122 Edward St., St. Thomas, Ont.
TEL. 519-631-0780/TWX. 610-356-6703 (LORAIN PRODCAN)

In Mexico —
Productos Lorain de Mexico, S.A. de C.V., Apartado Postal 77001
TEL. 576-82-77/TLX./01774308 (1774308 LORME)

RELIANCE COMM/TEC

1. SPECIFICATION

1.1 **GENERAL:** This LORAIN® SUB-CYCLE® Linear Control Ringing Generator is a plug-in module that supplies one ringing output, with adjustable output frequency and voltage.

1.2 OUTPUT RATING

1.2.1 **Power:** 50 VA when REA recommended frequency and voltage combinations are used.

1.2.2 Frequency

(A) **Range:** Continuously adjustable within any of the five following ranges:
(1) 16 - 19 Hz
(2) 18 - 25 Hz
(3) 23 - 34 Hz
(4) 25 - 39 Hz
(5) 34 - 67 Hz

(B) **Accuracy:** The initial frequency is ± 1/3 Hz or ± 1%, whichever is greater, with output variation from no load to full load within the specified input voltage range.

(C) **Stability:** Within ± 1/3 Hz or ± 1% of the adjusted value, whichever is greater, from no load to full load within the specified temperature and input voltage ranges.

(D) **Distortion:** THD is typically less than 5% of the fundamental frequency.

1.2.3 Voltage

(A) **Range:** Continuously adjustable within transformer tap selectable ranges, 65-90 VAC, © option, and 90 to 155 VAC, RMS.

(B) **Regulation:** ± 2% from no load to full load within the specified input voltage range.

1.3 INPUT RATING

1.3.1 **Voltage:** Negative 44 to 56 volts DC (positive ground)

1.3.2 **Filtering:** Noise fed back to a 100 ampere-hour battery is less than 22 dBrn C.

1.3.3 Current

(A) **No load:** 250 milliamperes at 48 volt input

(B) **Full load:** 1.65 amperes at 48 volt input

1.4 STANDARD FEATURES

1.4.1 **Input Protection:** One 5 ampere fuse is located in the negative lead.

1.4.2 **Output Protection:** Self-protected against output overloads or short circuits without opening the input fuse.

1.4.3 Alarms

(A) **Fuse Alarm:** Negative resistance battery is supplied at an alarm terminal if the input fuse opens.

(B) **Low Voltage Alarm:** Negative battery is supplied at an alarm terminal while ringing generator output voltage remains above approximately 55-65 VAC RMS.

1.4.4 **Remote Start:** Positive battery (ground start signal) supplied by customer turns on the ringing output.

LORAIN PRODUCTS
LORAIN, OHIO
RELIANCE COMM/TEC

POWER DATA

LORAIN® MODEL T5OP SUB-CYCLE®
LINEAR CONTROL RINGING GENERATOR
PART NO. 4871-060

ISSUE	CHG NO	DESCRIPTION	DR BY	DATE	GRP LDR	DATE
5	183-7891	DD 2-8-83 BP FEB 8 1983 65-90 VAC OUTPUT TAP ADDED.	R.LASH	2-8-83	DJ BECKER	12-12-79
			CH BY	DATE	APP BY	DATE
			——	——	C.MLCKOVSKY	12-12-79
		REVISIONS	ENGR BY	DATE		

PD4871-060

PAGE 1 OF 3

LP728-2/82

1. SPECIFICATION

1.4.5 **Local Programming**

(A) **Frequency:** Output frequency is selected by changing position of switches on a Dual Inline Package (DIP) switch and adjusting the FREQ ADJ potentiometer.

(B) **Voltage:** Output voltage is selected by adjusting the VOLT ADJ potentiometer.

1.4.6 **Paralleling:** Ringing generators with identical output power ratings can be parallieled to increase output power capability.

1.4.7 **Indicators**

(A) **GEN ON (LED):** Illuminates when ringing voltage is present at the generator output.

(B) **OUTPUT OVERLOAD (LED):** Illiminates when the generator output decreases due to an excessive output load.

1.4.8 **REA:** This unit meets REA Specification PE-40, dated February 19, 1971.

1.4.9 **Mounting:** This ringing generator is designed for mounting in a compatible LORAIN equipment cabinet.

1.5 ENVIRONMENTAL RATINGS

1.5.1 **Ambient Operating Temperature Range:** -9.5° C to +54.5° C (+15° F to +130° F)

1.5.2 **Storage Temperature Range:** -40° C to +85° F (-40° F to +185° F)

1.6 MISCELLANEOUS

1.6.1 **Schematic Diagram:** SD4871-060

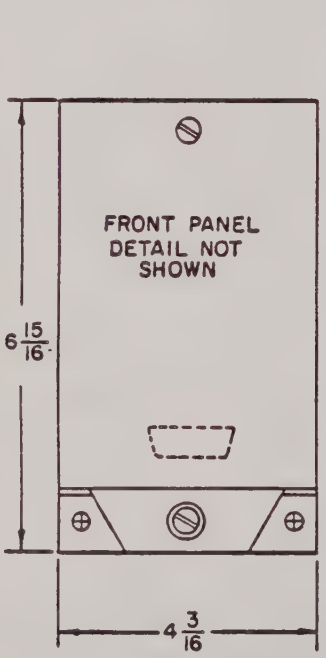
1.6.2 **Wiring Diagram:** T4871-060

1.6.3 **Instructions:** Section 4028

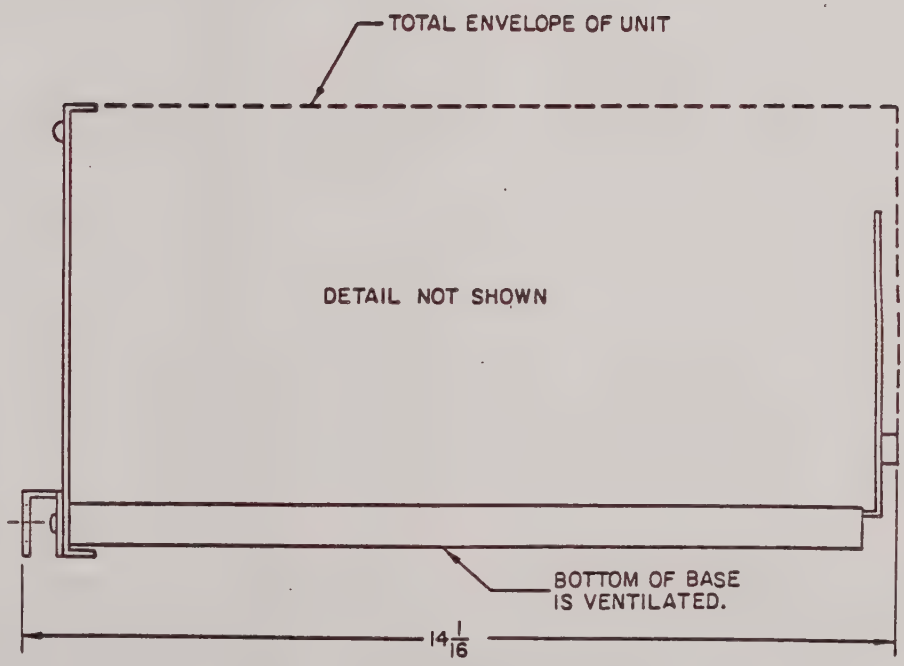
2. DIMENSIONS

NOTES:

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.
2. WEIGHT
   - A. NET: 14 LBS
   - B. SHIPPING: 15 LBS
3. FINISH: EQUIPMENT LIGHT GRAY



FRONT VIEW
FIGURE 2



SIDE VIEW
FIGURE 1

RECOMMENDED SPARE PARTS LIST
LORAIN® MODEL T50P RINGING GENERATOR
SPEC. NO. 4871-060

This Electrical Parts List is arranged alphabetically by part name. Spare parts are not usually required if adequate standby equipment is available and if the LORAIN equipment is installed at an accessible location so that parts can be readily obtained from Lorain Products stock. The ON-SITE quantity of spare parts will be sufficient for most repairs and should be sufficient for ten or less assemblies or models for at least 18 months. The Depot quantity is a more complete set of spare parts for remote areas or service for a number of sites. When ordering parts, please furnish equipment Model No., Spec. No., and Serial No. as given on the equipment nameplate.

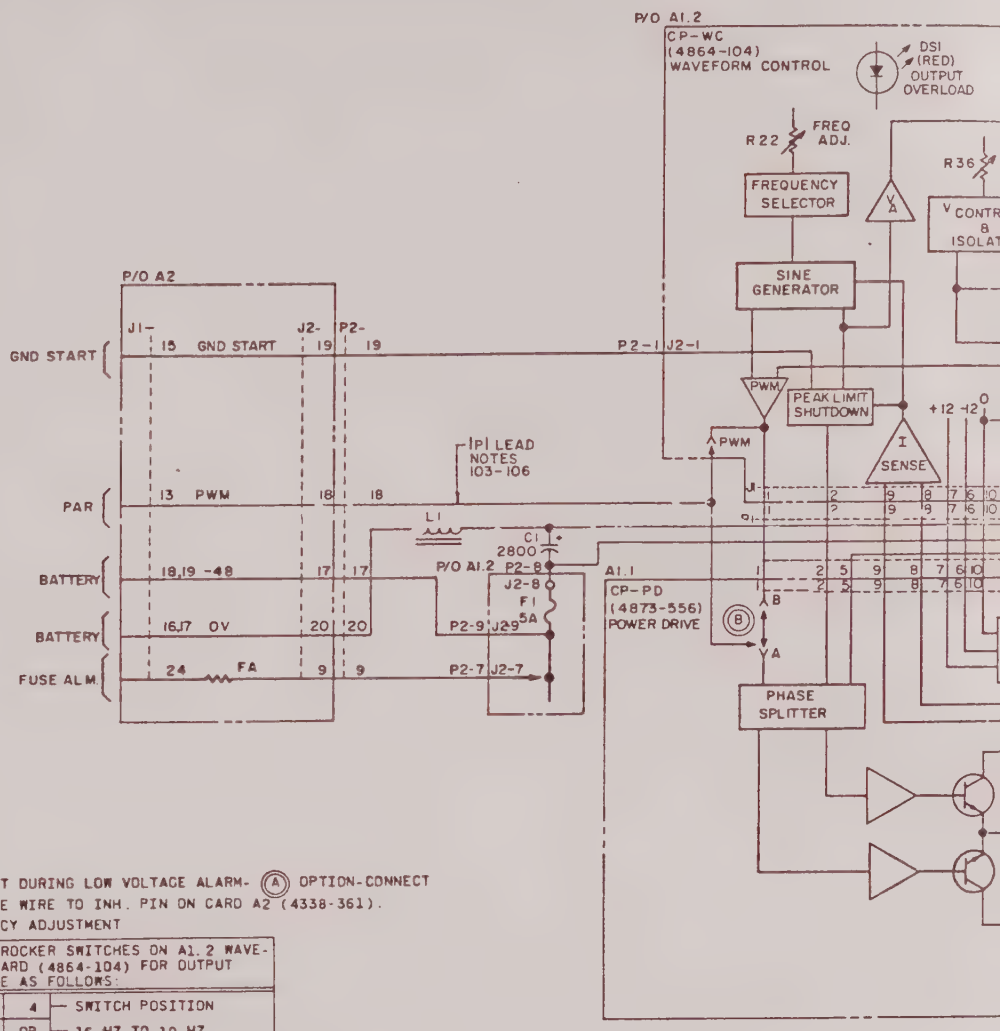
LPC Part Number	Description	Quantity of Recm. Spares ON-SITE	Depot
ASSEMBLIES			
4871-060	T50P Ringing Generator	1	1
FUSES			
2486-110	Input Fuse, Bussmann Type GMT5	1	1

LORAIN PRODUCTS
A RELIANCE ELECTRIC COMPANY
FIRST by Design
1122 F STREET LORAIN, OHIO 44052 216/288-1122
TWX 810-426-2130 (LORAIN PROD)
TLX 98-0505 (LORN PROD LORN)

ALSO WITH MANUFACTURING FACILITIES IN . . . . . .

CANADA
LORAIN PRODUCTS LTD.
122 EDWARD STREET
ST THOMAS, ONTARIO
TEL: 519-631-0780
TWX: 610-356-6703 (LORAINPRODCAN)

MEXICO
PRODUCTOS LORAIN de MEXICO S A de C V
APARTADO POSTAL 77001
MEXICO 10, D.F., MEXICO
TEL: 576-82-77
TLX: 01774308 (1774308 LORME)



ENGINEERING NOTES:

101. CURRENT INHIBIT DURING LOW VOLTAGE ALARM- (A) OPTION-CONNECT THE LOOSE WHITE WIRE TO INH. PIN ON CARD A2 (4338-361).

102. OUTPUT FREQUENCY ADJUSTMENT

SET MINIATURE ROCKER SWITCHES ON A1.2 WAVEFORM CONTROL CARD (4864-104) FOR OUTPUT FREQUENCY RANGE AS FOLLOWS:

1	2	3	4	SWITCH POSITION
CL	OP	OP	OP	16 HZ TO 19 HZ
CL	CL	OP	OP	18 HZ TO 25 HZ
CL	OP	CL	OP	23 HZ TO 34 HZ
CL	CL	CL	OP	25 HZ TO 39 HZ
CL	OP	OP	CL	34 HZ TO 67 HZ

CL= CLOSED
OP= OPEN

USE POT. R22 ON BOARD A1.2 (4864-104) TO OBTAIN REQUIRED FREQUENCY WITHIN RANGES.

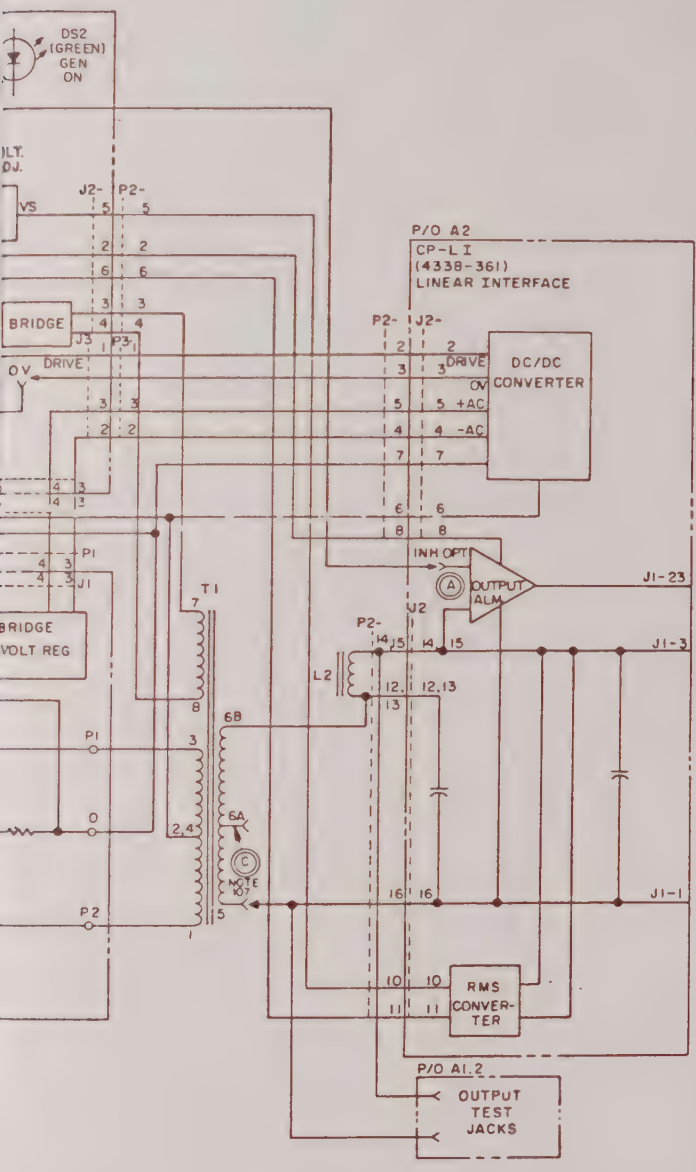
103 PARALLELED RINGING GENERATORS CONSIST OF ONE MASTER UNIT AND ONE OR MORE SLAVE UNITS. NORMAL (SINGLE GENERATOR) OPERATION IS IN MASTER CONFIGURATION

104. ADDITIONAL WIRING MAY BE NECESSARY ON THE EQUIPMENT CABINET BACKPLANE WHEN PARALLELING GENERATORS. CONSULT THE EQUIPMENT CABINET POWER DATA SHEET FOR DETAILS.

105. SLAVE UNITS- (B) OPTION-REMOVE BLUE JUMPER FROM PINS A AND B ON CARD A1.1 (4873-556). REMOVE |P| LEAD FROM PIN PWM ON CARD A1.2 (4864-104) AND CONNECT IT TO PIN A ON CARD A1.1 (4873-556) ADJUST VOLT ADJ POT. R36 ON CARD A1.2 (4864-104) FULL CCW OUTPUT FREQUENCY AND VOLTAGE ARE DETERMINED BY THE MASTER UNIT

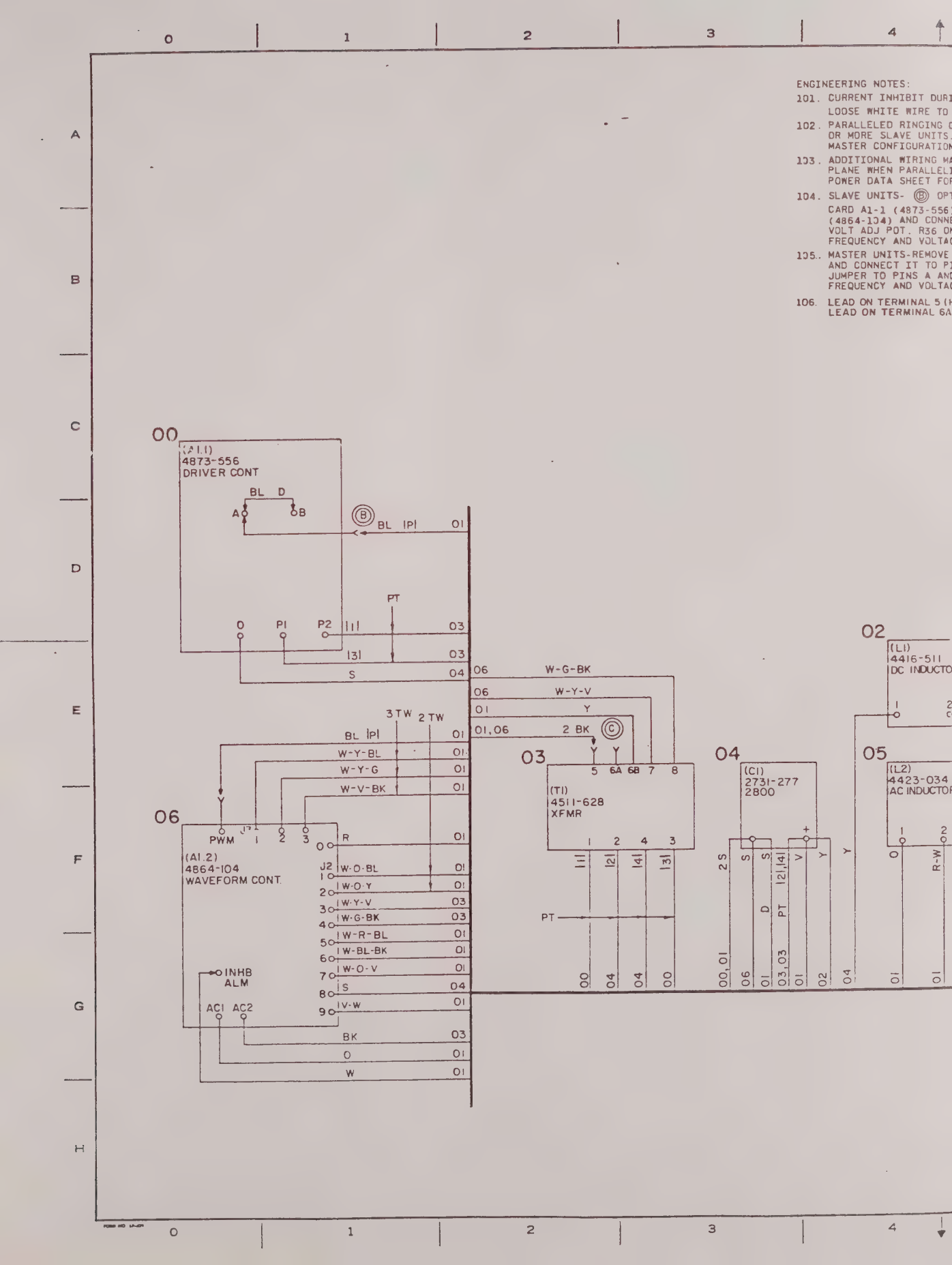
106. MASTER UNITS-REMOVE |P| LEAD FROM PIN A ON CARD A1.1 (4873-556) AND CONNECT IT TO PIN PWM ON CARD A1.2 (4864-104). CONNECT BLUE JUMPER TO PINS A AND B ON CARD A1.1 (4873-556) ADJUST OUTPUT FREQUENCY AND VOLTAGE AS REQUIRED.

107 UNLESS OTHERWISE SPECIFIED, T1,TERM 5 IS STANDARD CONNECTION. 90-155 VAC WHEN 65-90 VAC, OPTION (C) IS REQD, LEAD SHALL BE MOVED TO T1, TERM 6A.



REVISIONS			
NO.	CHKD BY / CHK DEPT NO.	DATE	DESCRIPTION
1M			NEW BP NOV. 20 1979
2			183-6988 1-14-80 J.V.T. CLARIFIED OPTION INFORMATION. BP JAN 16 1980
2 RM		8-19-80	D.A.C. CONNECTION CORRECTED.
3M			183-7296 9-24-80 J.V.T. REDRAWN FOR CLARIFICATION. BP SEP 25 1980
4			1837403 11-25-80 J.R. WIRING CHGD TO FACILITATE PARALLELING WITH PROGRAMMABLE'S BP NOV 26 1980
4	RM	2-24-81	J.R SPELLING CORRECTED
5			1837624 6-23-82 J.R NOTES REWRITTEN, DRAWING CORRECTED BP JUN 30 1982
6			1837891 1-19-83 T.F.M. OPTION (C) & NOTE 107 ADDED. BP

181-7068	DESIGN D.BECKER	ISS C
SCHEMATIC DIAGRAM FOR LINEAR CONTROL 50VA RINGING GENERATOR MODEL T50P	DRAWN BY J.TUTTLE	DATE 11-14-80
	CHECKED BY	DATE 9/16/80
	CHECKED BY D.J. Becker	DATE 9/19/80
	APPROVED BY	DATE
	RATING STANDARD	
	SD 4871-060	
LORAIN PRODUCTS CORPORATION LORAIN, OHIO LORAIN PRODUCTS (CANADA) LTD. ST THOMAS ONTARIO	DWG SIZE D	SHEET 1 OF 1


ENGINEERING NOTES:
101. CURRENT INHIBIT DURI
LOOSE WHITE WIRE TO
102. PARALLELED RINGING C
OR MORE SLAVE UNITS.
MASTER CONFIGURATION
103. ADDITIONAL WIRING MA
PLANE WHEN PARALLEL
POWER DATA SHEET FOR
104. SLAVE UNITS- (B) OPT
CARD A1-1 (4873-556
(4864-104) AND CONNE
VOLT ADJ POT. R36 ON
FREQUENCY AND VOLTA
105. MASTER UNITS-REMOVE
AND CONNECT IT TO P1
JUMPER TO PINS A AN
FREQUENCY AND VOLTA
106. LEAD ON TERMINAL 5 (H
LEAD ON TERMINAL 6A
00
(A1.1)
4873-556
DRIVER CONT
BL D
A
B
BL |P| 01
PT
0 P1 P2 |1| 03
|3| 03
S 04
06 W-G-BK
06 W-Y-V
01 Y
01,06 2 BK
3 TW 2 TW
BL |P| 01
W-Y-BL 01
W-Y-G 01
W-V-BK 01
06
PWM J1 1 2 3
(A1.2)
4864-104
WAVEFORM CONT.
R 01
J2
|W-O-BL 01
|W-O-Y 01
|W-Y-V 03
|W-G-BK 03
|W-R-BL 01
|W-BL-BK 01
|W-O-V 01
|S 04
|V-W 01
INHB
ALM
AC1 AC2
BK 03
O 01
W 01
03
(T1)
4511-628
XFMR
5 6A 6B 7 8
1 2 4 3
|1| |2| |4| |3|
PT
00 04 04 00
04
(C1)
2731-277
2800
2S S S D PT |2| |4| V Y
00,01 06 01 03,03 01 02
05
(L2)
4423-034
AC INDUCTOR
0 R-W
01 01
02
(L1)
4416-511
DC INDUCTO
04

5 | 6 | 7 | 8 | 9

S LOW VOLTAGE ALARM- Ⓐ OPTION-CONNECT THE
NH. PIN ON CARD A2 (4338-361).
NERATORS CONSIST OF ONE MASTER UNIT AND ONE
NORMAL (SINGLE GENERATOR) OPERATION IS IN

BE NECESSARY ON THE EQUIPMENT CABINET BACK-
GENERATORS. CONSULT THE EQUIPMENT CABINET
ETAILS.

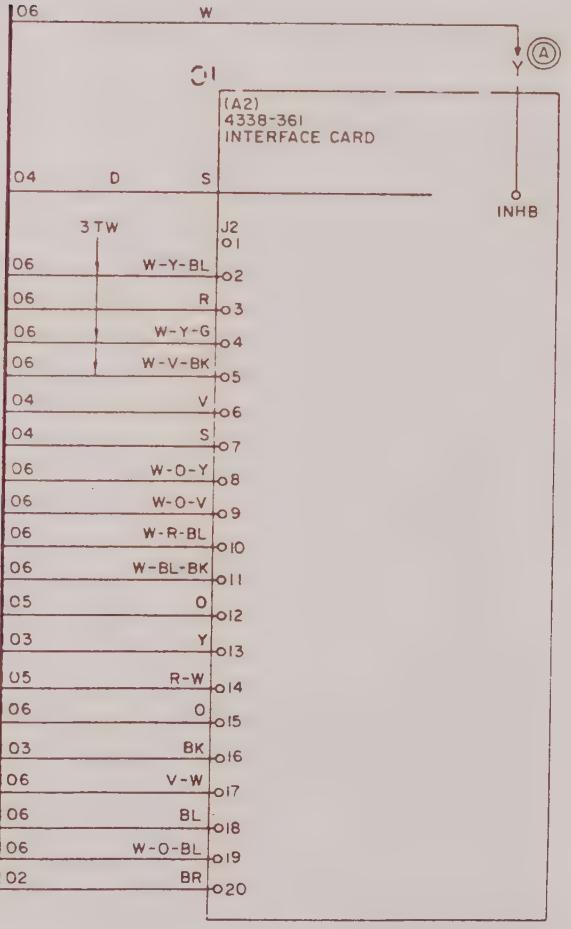
N-REMOVE BLUE JUMPER FROM PINS A AND B ON
REMOVE |P| LEAD FROM PIN PNM ON CARD A1..2
IT TO PIN A ON CARD A1..1 (4873-556).. ADJUST
ARD A1..2 (4864-104).. FULL CCW. OUTPUT
ARE DETERMINED BY THE MASTER UNIT.
LEAD FROM PIN A ON CARD A1..1 (4873-556)
PNM ON CARD A1..2 (4864-104).. CONNECT BLUE
ON CARD A1..1 (4873-556) ADJUST OUTPUT
AS REQUIRED.

H TAP) OUTPUT VOLTAGE RANGE IS 90 TO 155 VAC.
OW TAP) OUTPUT VOLTAGE RANGE IS 65 TO 90 VAC.

MANUFACTURING NOTES:

1. ALL WIRES TO BE 22 GA STRANDED, UNLESS OTHERWISE SPECIFIED.
2. PT-LEADS WHICH ARE PART OF COMPONENTS OR SUBASSEMBLIES.
3. 2 TW - TWO WIRES SHALL BE TWISTED TOGETHER
4. D - INDICATES LEAD IS A JUMPER
5. UNLESS OTHERWISE SPECIFIED, CAPACITANCE VALUES ARE IN MICROFARADS.
6. |GI, |PI, ETC - INDICATES WIRE LABELS.

REVISIONS			
	CHKD BY	DATE	DESCRIPTION
1	M		NEW BP OCT 22 197
2			1837403 11-25-80 J.R WIRING CHANGED TO FACILITATE PARALLELING WITH PROGRAMMABLE'S. R.K. 11-26-80 D.J.B. 11/26/80
3			1837624 6-23-82 J.R. NOTES REWRITTEN, DRAWING CORRECTED J. Dembinski 6-30-82 BP JUN 30 1982 D.J.B. 6/30/82
4			1837891 BP JAN 25 1983 1-26-83 D.A.C. OPTION C ADDED R.K. 1-27-83 D.J.B. 1/27/83



181-7068

WIRING DIAGRAM
FOR
LINEAR CONTROL
50VA RINGING GENERATOR
MODEL T50F

DESIGN	D SPANGLER	ISS A
DRAWN BY	J REESE	DATE 10-3-79
CHECKED BY	[illegible]	DATE 10 22 79
CHECKED BY	D.J. Baker	DATE 10/23/79
APPROVED BY	[illegible]	DATE 10/23/79
RATING	STANDARD	

T-4871-060

LORAIN PRODUCTS CORPORATION
LORAIN, OHIO
LORAIN PRODUCTS (CANADA) LTD., ST THOMAS ONTARIO

DWG SIZE D

SHEET 1 OF 1

5 | 6 | 7 | 8 | 9 PRINTED IN U.S.A.

LORAIN SERVI-GRAM

VOL. III ISSUE 1
SECTION 4230

LORAIN SERVICE® MODEL LS2000 PORTABLE RINGING GENERATOR TEST/LOAD UNIT

The Lorain Service Model LS2000 Test Set provides in a single package all of the instrumentation required to accurately measure, load and adjust single or multi-frequency ringing generators up to 100 watt capacity. All necessary connector cords and an AC line cord are provided with the test unit.

Designed as a portable test set with its own rechargeable battery pack, the unit can be readily carried from office to office to evaluate and reset voltage, frequency and current limiting levels for all types of ringing generators.

Quality instruments are used in the unit to assure the highest degree of measurement accuracy including a 3½" iron vane AC voltmeter and an electronic, digital display frequency meter.

The unit was originally developed for use by Lorain Service Engineers in performance of the Lorain Power Evaluation Program (PEP) and is now offered as a commercial service product.

APPLICATION

The Model LS2000 Test Unit can be used to measure, load and adjust the ringing voltage, regulation, current limiting and frequency levels for all types of ringing generators up to 100 watts capacity. A special circuit in the unit permits accurate reading of both sinusoidal and vibrator-type ringing wave shapes.

OPERATING CHARACTERISTICS

Input: The unit can operate from either commercial AC power (standard 120 volt, 60 Hz. single-phase) or its own internal rechargeable 12 volt battery source. The unit will operate for up to 8 hours continuous on the battery and full recharge time is approximately 10-16 hours.

MODEL LS2000

Ringing Voltage Input: 140VAC (maximum) for continuous loading; 150VAC maximum for intermittent duty.

Load Range Steps: Coarse load adjustments provide steps of 12.5, 25, 50 and 75 watts which can be switched in or out in various combinations to attain virtually any load desired. Additionally, a continuous control provides 4 to 17 watts load for fine adjustment.

LOAD ADJUSTMENT SWITCHES

The unit also provides external load jacks which permit connection and monitoring of actual office ringing loads.

LORAIN SERVICE
RELIANCE COMM/TEC

Metering

Frequency meter: Electronic, (C-mos) Crystal-Controlled Digital display with ranges for 0 to 99.9 Hertz (±0.1 Hz. accuracy) or 0 to 999 Hertz (±1.0 Hz. accuracy).

Input sensitivity is 20 volts, while input impedance is 100K ohms at 1 to 1,000 Hertz.

AC Voltmeter: 0 to 250 volts, 3½" iron vane meter with ±2% full scale accuracy.

Load Ammeters: Dual meters for 0-500 milliamperes and 0-2 amperes. Both meters are 2½" with ±2% full scale accuracy.

Recharge Circuit

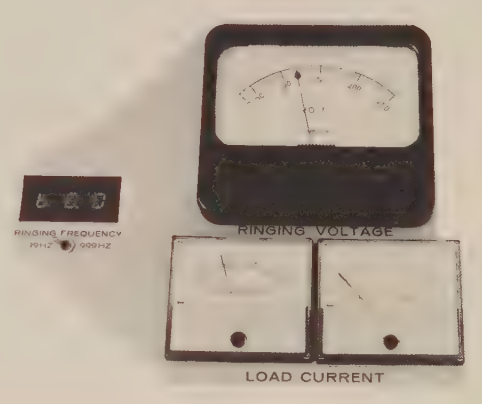
Automatically activated during AC line operation to provide a current limited and voltage regulated charge level. Time for a full recharge is approximately 10-16 hours.

The test unit provides a low voltage "recharge battery" lamp to indicate a low battery condition.

Leads

The test unit provides 10', 20 gauge (red and black) test leads terminated with pin jacks and alligator clips for connection to various ringing generator terminals for testing.

A 6' input cord, which can be removed for battery operation, is also provided as standard equipment.



TEST LOAD METERS

Physical Characteristics

The Model LS2000 is housed in a carrying case that measures 18½" long by 14¼" wide by 5" high. Weight of the unit is 10 pounds.

Instruction Manual

The instruction manual includes operating procedures, calculations for determining load current vs. output voltage (with table), a schematic diagram, materials list and instructions for internal battery charger adjustment.

LORAIN PRODUCTS

1122 F Street, Lorain, Ohio 44052
(216) 288-1122/TRT: 196131 LORN UT/WUD: 980505 (LORN PROD LORN)

In Canada —
Reliance Telecommunication Products Ltd., 122 Edward St., St. Thomas, Ont.
TEL. 519-631-0780/TWX. 610-356-6703 (LORAIN PRODCAN)

In Mexico —
Productos Lorain de Mexico, S.A. de C.V., Apartado Postal 77001
TEL. 576-82-77/TLX./01774308 (1774308 LORME)

RELIANCE COMM/TEC

FOR PARTS OR SERVICE, CONTACT THE NEAREST

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OHIO REGIONAL SERVICE CENTER
1313 G Street
Lorain, Ohio 44052
Telephone: 216/288-1122

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Arlington, Texas 76011
Telephone: 817/640-1134

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Costa Mesa, California 92626
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Telephone: 312/231-5775

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Telephone: 408/263-1303

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Telephone: 404/449-0840

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122 Edward Street
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Wheat Ridge, Colorado 80033
Telephone: 303/422-6213

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- Battery Charger Maintenance - No. L302AV
- Storage Battery Maintenance - No. L301AV
- Central Office Ground Maintenance - No. L401AV

Factory or On-Site Training School

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- Ringing Generator Test Set - Model LS2000
  (Includes loads, metering, digital frequency counter)
- 130V Converter Test Load - Model LS1000
  (Variable loads to 6 amps)

Power Evaluation Program (PEP)

- Power analysis program for all central office power equipment including batteries.

Power Upgrade and Modernization Services

- Including engineering, fabrication and complete installation

Maintenance Contracts

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Handy and practical, helps keep down time to a minimum.

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